CHILTON'S

July 16, 1984

IRON AGE METALS PRODUCER

WORLD CONTINUOUS CASTING REPORT: NEW PROJECTS ON THE HORIZON

Acid Rain: Coal's Three Mile Island?

Plus
In Plant Spotlight

And
The Hot Spot

JULY 16, 1984 VOL. 227, NO. 14

CHILTON'S
IRON AGE
METALS PRODUCER

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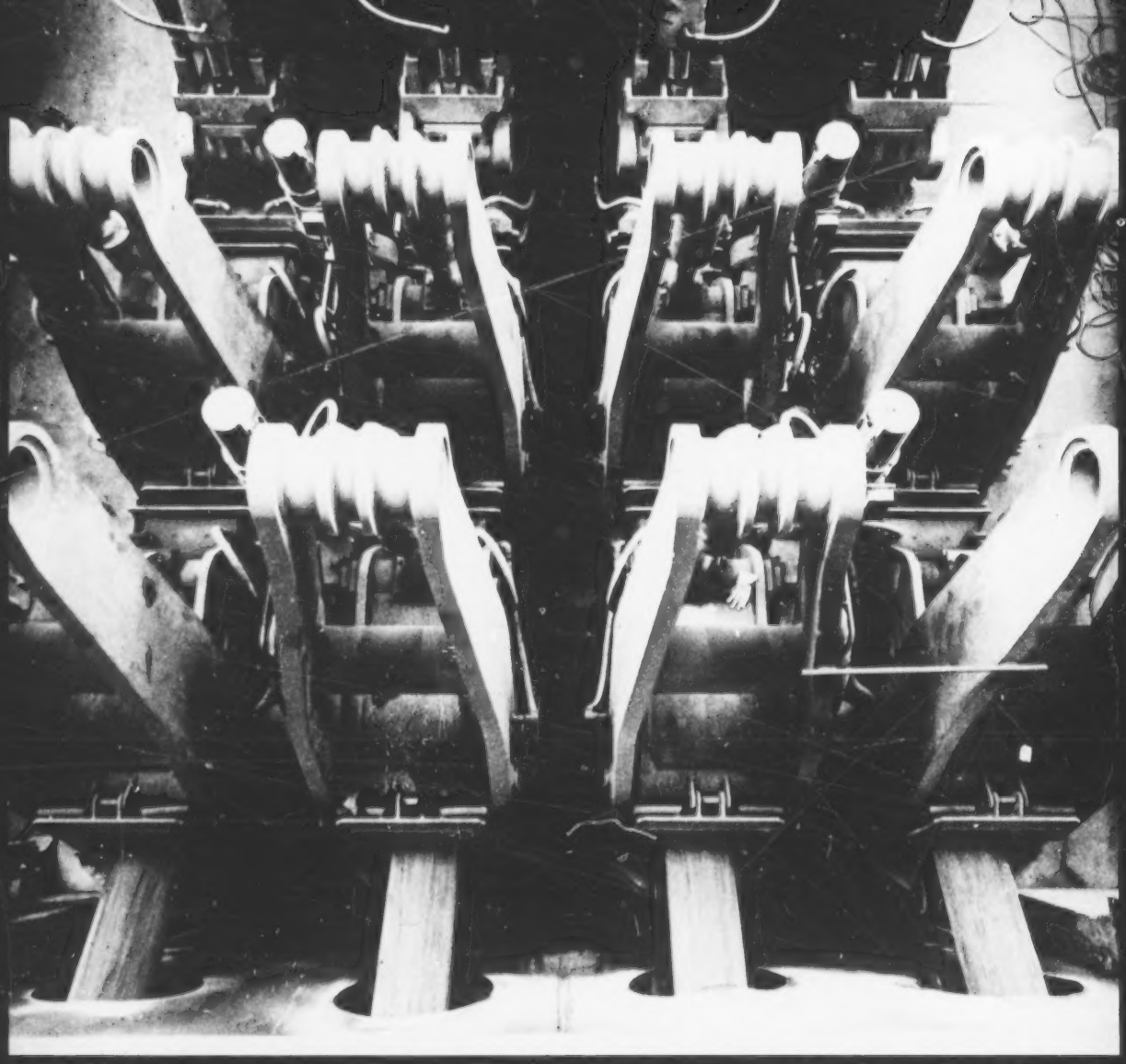


Italy's biggest caster at SETA, Brescia. Billets 420 mm diam. are produced on a Danieli continuous caster.

WORLD CONTINUOUS CASTING REPORT: NEW PROJECTS ON THE HORIZON

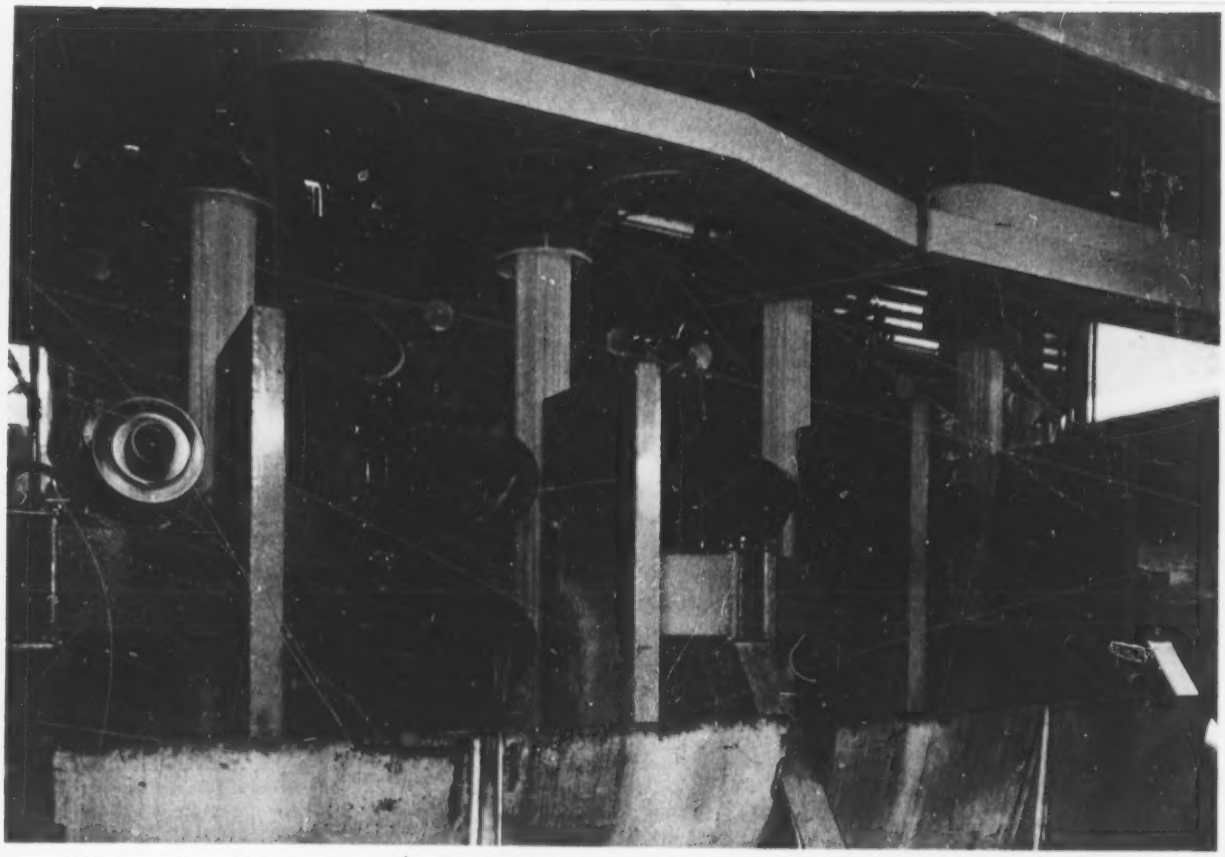
BY KEITH W. BENNETT & GEORGE A. WEIMER

Millions of tons of capacity are being added, all designed to make dramatic improvements on cost efficiencies and energy use.

World Slab Caster Report: New Overseas Interest

The U.S. has been the hottest market for new slab casters. Now, a wave of inquiries from off-shore steel plants suggest, after a two year lull, they want to get started on more new slab casters of their own.

But U.S. Steel at its Gary Works, with a new pair of slab casters for mid-1986 operation rated at 3.3 million annual tons will have the largest slab casting facility among the *New Wave* casters. It will produce 9.1 in. (231 mm) thick steel slabs in widths from 33 in. to 90 in. One of the two single strand cast-



Innse of Milan, Italy is working on direct-to-mill slab projects. Photo shown is at Dalmine, in Bergamo, Italy.

ers will have a split mold to make narrower slabs of 33 in. to 39 in. width. Concast, Inc. will design and fabricate the state-of-the-art fully computerized machines. It will make Gary Works the biggest slab caster in the U.S.

The U.S. has 25.5 million tons of capacity in slab casters. Bypassing the process of rolling ingots can save $40 to $50 per ton of slab. U.S. plants will add 12.4 million tons between now and 1986. Slab casters used to take 24 months, but some are now coming onstream in as little as 18 months, so some casters not let yet could also be on by 1986.

Overseas capacity is hard to track, but could rise 19.25 million tons, 1983 to 1986, despite the lull in new orders overseas in 1982-1983.

North American industry reports suggest that Armco, IPSCO, Dofasco, Stelco, and National Intergroup are at least looking at more casters; and at least two casters could be announced for North American plants some time this summer. At least 13 slab casters had been scheduled to come on this year and next in foreign plants.

The new machines are big and fast. Where the early wave of slab casters of the 1950-1975 period were rated at 40 ipm (1 meter per min.), the new machines are usually rated at 65-70 ipm (1.65-1.7 m/m), while still concentrating on a slab thickness of 9 in. (228mm).

One equipment builder told *Iron Age* last year, "Companies build roughly for 9 in. slab thickness because of the limited strength of their hot strip mills. You'll see 10 in. to 12 in. thickness on slab from these casters."

This is supported by some of the new carbon steel casters like the LTV plant at Chicago. The two casters at Indiana Harbor have a 19 in. capability in thickness, matching one of the most powerful strip mills in the U.S.

Engineers say some casters could be capable of 72 ipm (1.8 m/m), but mill operators talk of slower speeds, though one LTV-Indiana Harbor machine was rated at 71 ipm. This caster is a single strand of 40-78 in. width (1016 to1081 mm). Designers say casters of 78.7 ipm (2 m/m) are feasible and rate some offshore slabbers that high. An American engineer mentioned a Japanese machine for 11 in. thick slabs at speeds over 2 m/m.

Three New Casters

Bethlehem Steel will have three new casters in operation by 1986. Its first went onstream in 1975 at Burns Harbor, rated at 65 ipm (1.65 m/m) with a 1.8 million ton capacity. With the new 1985 caster at Burns Harbor, and the bigger machine (2.9 million annual tons at Sparrows Point), the company could produce a total of 6.9 million tons of slab yearly.

LTV Steel, with new casters at Cleveland Indiana Harbor, already has an apparent capacity of 4.9 million

Horizontal Steel Casting is Alive and Well in the World Market

Where is a horizontal steel casting process that really works? Davy McKee of Sheffield, England, said it has had one since 1975, but Europe was not ready for it.

Davy McKee's first production plant, a two strand installation at NKK of Japan's Fukuyama plant, commissioned in 1978, so impressed NKK they took out a license. A second plant, feeding directly through a reheating furnace to a rolling mill, has operated at NKK Nichjyu Koki since January 1981. Davy McKee, which receives all the updated operating experience from NKK, said NKK reported big prospects in the U.S. Davy McKee is equally confident about South Africa.

The only other European manufacturer which has sold horizontal continuous casting machines is Technica Guss, West Germany. This company has a single-strand horizontal caster in West Germany, a two-strand machine in the U.S. and a two-strand machine in Czechoslavakia.

According to Davy McKee, the fundamental difference between the British and German designs is that the latter is a two-strand, slow speed type, whereas the British one operates at speeds similar to conventional vertical continuous casting.

Davy McKee's research and development center began the horizontal casting of steels at an experimental setup in Stockton, England, during the mid-1960's. "We set up a pilot plant in 1975," said continuous casting research manager, Darryl Toothill at the METEC exhibition, Düsseldorf, West Germany, in June. "But the steel industry in Europe at that time was in a bad way, and showed no interest." He continued: "Three Japanese steel companies approached us for a plant and we chose NKK, which installed a two-strand machine at Fukuyama. This led to a license agreement."

It seems NKK has every confidence in the process, and the first production machine at Nichjyu Koki was commissioned within two weeks of installation and produces 105 mm square billets in carbon steels from two strands.

What's more, you would not believe the quality of scrap fed into Fuchjyu Koki's furnace—it has up to 1 pct zinc content: "Only a horizontal caster could cast that!" commented Mr. Toothill. A second machine was sold by NKK to South Korea. It produces 186 mm square billets in first quality machining grade steels, low alloy steels and spring steels, in one strand fed by a 15 ton electric arc furnace.

NKK has developed the process to produce a small bloom caster. It produces a 270 mm diam. bloom, but it can do 330 mm diam., according to Mr. Toothill. The "Horicast" process, as Davy McKee calls its tradename, will produce billets in all low and high carbon steels (0.5 - 1.2 pct C), low alloy stainless steels (martensitic and austenitic), nickel-steels and two-phase stainless steels. Casting speeds are claimed to be similar to those of a vertical caster.

What does the process offer? On the "plus" side, low capital investment under a low roof.

It is virtually 100 pct automatic: "There are no mold operators," confirmed Mr. Toothill. "Though no one has asked us or NKK, yet, for an automatic stream from a ladle, it's automatic, except for opening the ladle."

The size of the market, said Mr. Toothill, should be considerable for a small, 5-20 ton machine capable of producing a wide range of steel qualities.

Alternatively, existing users of vertical casting machines, might make use of a small additional horizontal caster to produce those aluminum-killed steels not possible in the vertical machine, or add specialty steels to the salesbook.

Are there any "minuses"? asked *Iron Age*. For one, apparently, you can't achieve high production levels. On a vertical installation, sequence casting boosts productivity.

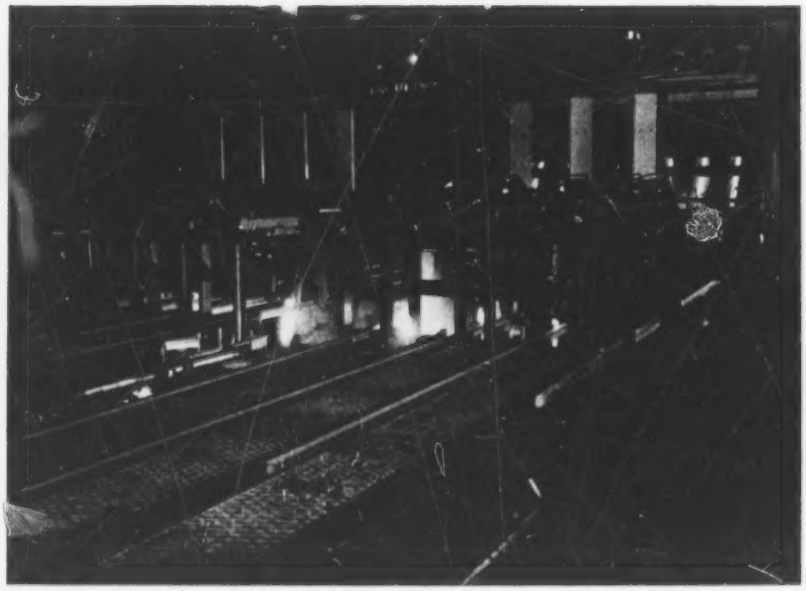
On the horizontal machine only three to four ladles can be cast in sequence. But the tundish and mold constitute a completely closed system, so metal entering the one-piece mold is out of contact with the atmosphere. Horicast machines also use spray cooling, though perhaps its not needed with stainless steels.

Mr. Toothill also says that the surface finish of Horicast products is "different" in terms of the mode of solidification. Davy McKee said that the efficiency of the Horicast mold allied with secondary cooling results in optimum solidification conditions over a wide range of casting conditions. It is claimed to result in a short liquid core with a low and symmetrical stress distribution. So there is little segregation and central porosity and freedom from cracking, even on thermally sensitive grades of steel.

Asked about the future of Horicast in Europe, Mr. Toothill said that Davy McKee has applied to the ECSC to fund a project in France. The partners would be the newly-formed Compagnie Francaise des Forges et Fonderies (CFFF or C3F—a wholly-owned USINOR subsidiary originally belonging to Creusot-Loire) and the IRSID (Institut de Recherches de la Siderurgie Francaise—Paris and Metz).

If successful, the partnership would install a prototype two-strand machine in France. No UK company has to-date expressed any interest.

Meanwhile Davy McKee and NKK continue development work to reduce maintenance and operating costs and apply Horicast to high speed steels.



Rokop Corp. has built an 8 strand billet continuous caster for a facility at British Steel Corp.

Slabs are flame cut as they leave the continuous slab caster at Bethlehem's Burns Harbor Ind., plant.

tons per year. Armco Steel with one carbon steel caster of 1.02 million annual tons and two large stainless and specialty steel slab casters, already has a 1.8 million annual ton apparent capability. Since the new slab casters in development appear to average about 1.5 million annual tons, if Armco elected to go for a fourth caster it could arrive at a total 3.3 million annual ton of annual capacity.

Inland Steel company, by 1986, will have two new casters besides the 1.8 million ton caster that came onstream in 1982 which will then give the company a total 4 million tons, though one of the two machines is a two strand machine to make both blooms and slabs.

National Intergroup also is heavy in slab capacity, with a rated 3.7 million tons on its two slab casters, even after spinning off the 1.2 million tons Weirton Steel caster.

McLouth Steel (Tang Industries) is in the same heavyweight class as LTV, rating its slab thickness at 9 to 12 in. (228 to 304 mm), with a 2.2 million ton annual capacity on four single strand carbon steel machines rated at 60 to 65 ipm (1.3 m/m).

Wheeling-Pittsburgh's 1983 unit is rated at 2.4 million annual tons, so it's also part of the *New Wave* with a machine rated at a top speed of 60 ipm (1.3 m/m) for slabs of 8 in. thickness (203 mm) and 40 to 80 in. (1016 to 2032 mm) widths on a single two strand machine.

U.S. Steel has one of the oldest carbon casting machines in the U.S., dating back to 1967 at Gary. Built as a vertical caster, it was extensively modified in 1982 to give it a 30 pct capacity gain. It has continued to push up the rating on the machine. *Iron Age* has estimated that it could hit 1.7 million tons by early 1984, pouring 9.3 in. (236 mm) thick slabs in a single strand that can vary from 46 to 78 in. (1168 to 1982) width at casting speeds of 63 to 65 ipm (1.6 m/m). With its 1.14 million ton machine at Baytown, it had a capacity of 2.84 million annual tons. The *New Wave* casters at Gary could raise the total at Gary's No. 1 and No. 2 caster shops to 6 million tons. It has been speculated that the original Gary caster could, with some more work, be pushed to just about the 2 million annual ton mark.

Foreign Development

The newest overseas machines appear to be POSCO Kwangyan Steel Works in South Korea, scheduled for 1986 at 2.7 million annual tons (metric) or about 3 million U.S. tons. Mannesmann Demag rated this as a 9 in. (230 mm) thick slab, and in widths of 32 to 63 in. (800 to 1600 mm) on two twin strand machines.

At Altos Hornos de Viscaya, Spain, three single strand machines are rated at 2.6 million metric annual tons in slab thicknesses of 6.69 to 10.23 in. (170 to260 mm), and widths from 23.6 to 74.8 in. (600 to 1900

Planned for 1985 operation, a four strand caster Siderugica Lazaro Gardenas, Las Truchas, Mexico, is rated at 2 million annual tons with a slab thickness of 7.87 to9.84 in. (200 to 250 mm) and widths from 47.2 to 74.8 in. (1200 to 1900 mm).

It's a measure of the surge in slab caster, both in carbon and specialty steels (though the emphasis is on carbon casters), that Mannesmann reported 98 machines in which it has been a supplier in service last year, and 108 machines this year; aggregating 174 strands.

Concast, which pioneered with a stainless slab caster at Atlas Steel in

	Continuously Cast Raw Steel Production (In Millions of Metric Tons)			Pct of Total Raw Steel Production		
	1981	1982	1983	1981	1982	1983
Belgium	3.8	3.3	3.9	30.6	33.0	38.4
Denmark	3.8	0.5	0.5	95.8	96.8	97.4
W. Germany	22.3	22.2	25.7	53.6	61.9	71.8
France	10.9	10.8	11.2	51.4	58.5	63.8
Ireland	—	0.1	0.1	—	100.0	100.0
Italy	12.6	14.1	14.9	50.8	58.5	68.2
Luxembourg	0.3	0.7	0.8	7.0	19.4	24.1
Netherlands	1.2	1.4	1.6	21.2	31.0	35.9
United Kingdom	5.0	5.3	7.0	31.8	39.0	46.6
EEC Total	56.6	58.3	65.7	45.1	52.8	60.4
U.S.	22.2	19.6	23.6	20.3	29.0	31.2
Canada	4.8	3.9	4.8	32.2	32.8	37.4
North America Total	27.0	23.5	28.4	21.7	29.6	32.1
Japan	71.8	78.4	83.8	70.7	78.7	86.3
Korea	4.8	6.0	6.7	44.3	51.1	56.6
Taiwan	1.8	3.4	4.3	58.5	80.9	84.6

Source: IISI

Canada in 1954, reportedly shared in 14 slabbers in U.S. plants and 84 worldwide by 1983. It figured the world total for casters of all types (billet, bloom, slab) at 1144, of which it had participated in 409 by one report. Its slab caster at National's Granite City Steel plant in 1981 led off the move to variable width molds in the U.S. (49 to 84 in., or 1245 to 2135 mm).

In the 1984-1985 period, it reported eight casters outside North America scheduled for operation in carbons or alloy steels. Included are: Sociedad Mixta Siderugica Argentina, in Argentina with a machine casting carbon and alloy steel slabs in 29 to 63 in. (750 to 1600 mm) width, and 6.29 to 9.84 in. (160 to 250 mm) thicknesses, with two strands. At SIDMAR in Belgium, a two strand machine for 1985 was rated at slab widths of 47.2 to 94.4 in. (1200 to 2400 mm), and 8.62 to 9.05 in. (210 to 320 mm) for carbon and low alloy slab.

Companhia de Acero Del Pacifico, S.A., Chile listed a one-strand machine for 1984 operation at 23 to 41.3 in. (585 to 1050) width; and thicknesses from 7.28 to 10.23 in. (145 to 260 mm) thickness. At Nippon Kokan KK, Japan, at Fukuyama Works, a 1984 dated machine with two strands is rated at 31.5 to 64.9 in. (800 to 1650) width, and 8.66 to 9.84 in. (220 to 250) slab thickness in carbon steel. Spain, like Gary Works, appears to be modifying two earlier sites for 1984 operation at Empress Nacional Siderugica, A.A.; both for carbon steel casting.

Another important caster supplier is Voest-Alpine, which also figured in Sociedad Mixta Siderugica Argentina caster rated at 1 million metric tons in Argentina; as well as two, two-strand machines for POSCO (Pohang Iron & Steel Co. Ltd.) in Republic of Korea. It rated these machines at 4 million annual metric tons, for 1981 completion; the same year that Voest-Alpine brought on a 1.1 million metric ton slab caster at Linz, Austria. It also lists a two strand for 1984 operation at VE AHB in Germany, rated at 2 million metric tons in carbon and alloy steels with a top feeding system; as well as a 1.4 million metric ton pair of single strand machines for 1985 operation for Iron & Steel Projects Secretariat of Heavy Industries, Libya.

The VE AHB machine has a reported casting range of 33 to 78.8 in. (850 to 1850 mm) width, and 5.9 to 13.77 in. (150 to 350 mm) thickness. Dimensions for the Libyan machines are somewhat smaller: 24.8 to 62.9 in. (630 to 1600 mm) widths, and 5.9 to 7.87 in. (160 to 190 mm) thickness; for production of carbon and alloy slabs, as with the German machine.

Asked the casting speeds of some of the machines it has worked with, Voest-Alpine reported the Pohang (POSCO) machine was rated at a fast 70.8 to 78.7 ipm (1.8 to 2.0 m/m). A 1981 machine at Voest-Alpine AG, Linz, Austria, has a wider speed range from 42.2 to 78.8 ipm (1.2 to 2.0 m/m), on a 1.1 million metric ton machine with one strand for carbon and alloy steels; and thickness varies from 7.87 to 11.81 in. (200 to 300 mm).

Since 1973, Voest-Alpine has figured in the construction of at least five machines rated at 2 million metric tons per machine. The average reported

casting speed on these machines at the top was 70.8 ipm (1.8 m/m) and three of them were cabable of at least 2 m/m. The 1.1 million ton (metric) machine at Linz could hit that top figure.

Among owners of and shoppers for new casting machines, another name heard often is Hitachi-Zosen. It is a contributor of technology in four new slab caster installations in the U.S., including the Cleveland LTV caster, Wheeling Pittsburgh, Inland Steel, and Ford's Rouge Steel. It's credited with some 30 similar jobs in Japan, besides work in Brazil, China, Korea, Taiwan, Australia and Africa.

Average Caster Size

While a lot of industry observers talk about the advent of 2 million ton slab casters in the future, a Hitachi source agrees that the average caster is more apt to be in the 1.5 million ton class, with production on two strands. It can be either spray-cooled or mist-cooled, though the newer machines tend to add mist cooling. Caster lengths are about 131 ft. (40 m) and thicknesses range from 8 to 10 in. (203 to 254 mm). And a point frequently heard gets more confirmation from Hitachi sources: Where mold length of 27.5 in. (700 mm) was once common, the feeling now is 35.4 in. (900 mm) is better.

Armco has been reported as one of the U.S. companies with some interest in a caster. But its first move will be to modify a six strand caster for 1986 completion that will consolidate two billet strands into a single slab strand. Again, this looks like it would be a 9 in. thick slab, though the company seems to have looked at possibilities from 7 in. to as much as 12 in. Like all the new slabbers, this would have a variable width mold, so that a possible range could be from 38 in. to 66 in. (965 to 1676 mm), on a single strand to make 32 ft slabs, in a metallurgical length of about 100 ft., with spray nozzle cooling.

Even spray cooling has changed over the years. Mannesmann Demag noted that from an original 1000 nozzles, wide angle flat jets allowed it to cut back to 100 nozzles. As a guess, the Armco modified caster looks capable of some 360,000 tons of slab per year.

Typically, molds now oscillate in a total 8 mm movement. A typical machine height appears to be 44 to 50 ft. Caster radius, however, can run from 33 to 88 ft., though the 88 ft. radius segment was preceded by a 48.5 ft. arc, just ahead of it in the caster. Where earlier machines had a single "unbending point", now the range is two to four; though one user and one builder point out their system has none but is a continuous curve.

Rated at 1.8 million tons, the Ford Rouge caster is for 1986 operation. The Rouge plant has been estimated at 3.6 million tons annual hot metal capacity. This is a Hitachi-Zosen and Mannesmann Demag caster, part of a consortium headed by Mitsubishi. It's a curved mold machine, with about 897 ft from mold to exit pinch roll. That two strand machine is rated at a high top speed of 72 ipm (1.82 m/m) casting rate. A BOF is the main hot metal source but could be augmented with electric furnace steel from an existing shop if it is needed.

The Bethlehem casters are scheduled for startup in 1986. The casting length here, or metallurgical length, is 116 ft. There is no slitting on the line, though some slab is cut cold as U.S. steel at Gary does for its tinplate slab. These machines have a casting radius of 33 ft., and the number of tundishes gives a clue to the auxiliary cost of a slab casting machine. With two tundishes in use, the Sparrows Point caster has a total of 13; and Burns Harbor has 10. The cam operated mold oscillator can go from 20 to 250 strokes per minute. These are straight mold machines.

As with the Inland Steel machines, these machines have variable width molds and this is the accepted future pattern for slab casters. Burns Harbor also has an auxiliary slab cutting system on line that appears to be unique, and allows hot cutting slabs to lengths as short as 6.33 ft. without waiting to cool the slab.

IPSCO, Inc., which put in an 80 in. hot strip mill in 1979 at its Regina, Sask plant, confirms that it is a candidate for a slab caster, possibly a single strand, to handle 650,000 annual tons of hot metal output. It would want a variable with mold for slabs 7 to 10 in. (177 to 254 mm) thickness as a general range; and 40 to 84 in. (1016 to 2133 mm) width at casting speeds of perhaps 1.1 m/m. But this could be a long way off, perhaps as much as 24 months.

National Steel has had long range plans for a new caster at Great Lakes. But like IPSCO, there may be some time before these are firmed up. This is an interesting plant, because its 104 in. (2641 mm) slab caster is wider than any other slab caster has ever been.

New Commitment

Dofasco, Hamilton, Ont., could be making a slab caster decision this year, company sources confirm. Dofasco has a 4.2 million ton ingot capacity and currently has two hot slabber mills and is good enough at scheduling to be able to roll the slabs hot, from hot ingot. It would look to continue direct hot rolling from slab caster to hot strip mill. It hasn't yet set a time limit on its final decision, and may not even have firmed its specs yet on what it would want in a slab caster.

Stelco put on a slab caster in 1980, a twin strand machine at its Lake Erie Works. It also has added its second hot strip mill. The present machine is rated at 1.44 million metric tons in 44.48 to79.92 in. (1130 to/2030 mm) widths; and 9.5 in. (241 mm) thickness, though a recheck suggests a range of 200 to 240 mm, or 7.87 to 9.44 in. This is a Mannesmann Demag caster with curved mold to make slabs up to 49.2 ft (15 m) weighing up to 36 metric tons.

The casting rate can range up to 1.5 m/m (59 ipm) in a machine with a 95.1 ft. (29 m) metallurgical length; and one which can put through from 1.87 to 5.79 metric tons per minute. There had been some disagreement in the reports, but apparently the Stelco Lake Erie machine couldn't change mold width "on the fly". One mold has now been converted and the entire machine can now share that advantage. The machine slits slab off-line. It's also added more secondary cooling, so that it has 10 m of spray cooling, followed by 10 m of air mist cooling.

The other caster, if approved, could be in as early as 1986 at Stelco's Hilton Works.

Wheeling Pittsburgh came in during the early part of the *New Wave*, in 1983, with its 43 to 80 in. (1016 to 2032 mm) wide slab caster. About 45 pct of its product is slit and all of it is for

the hot strip mill. It mounts two tundish cars with eight tundishes and 13 ladles. It is a curved mold machine with an electromagnetic mold level control described by its users as "excellent". Metallurgical length is 82 ft. or (25 m) with a very complete use of computer control in the machine.

It is believed the machine can cast at 63 ipm (1.6 mm), though it may have been running at a slower speed.

BILLET & STRAND CASTERS

In the past two years, Mannesmann Demag has built 14 strand casters from Lorain, Ohio to India and Paraguay. These include, besides the well-known U.S. Steel-Lorain, Ohio and Bethlehem/Steelton, Pa. works, one of the smallest for Siderugica Cearense in Fortaleza, Brazil, which has a capacity of only 90,000 annual tons. The largest in the time period is Bethlehem's at Steelton with a rated capacity of 1.25 million tons.

One at Nippon Kokan's Kabushiki Kaisha Ogishima Works is nearly as large with a rated annual capacity of 1 million tons of rounds, Mannesmann Demag noted.

According to the company, the smallest strand caster it has built since 1952 is an installation at Gebr. Bohler & Co., AG, in Kapfenberg, Austria, which is rated at only 7,500 annual tons of rounds. The Bethlehem facility, according to Mannesmann Demag's records, is its largest to date.

"This plant will be one of the most efficient producers of high-quality steel rails and semi-finished steel in this country," said Bethlehem president Walter F. Williams. "It may actually be the most efficient producer in the entire U.S."

The Steelton, Pa. plant's caster, the second of four casting machines Bethlehem has earmarked for its plants, will produce "jumbo blooms, the largest blooms continuously cast in the United States," Mr. William noted.

The blooms will have a cross-section measurement of 14.6 in. by 23.6 in.

Bethlehem has been operating a continuous caster at its Burns Harbor, Ind. plant since 1975 and in 1983 announced a $500-million program to provide a continuous caster for its Sparrows Point, Md. plant and a second caster for Burns Harbor.

Sparrows Point's 2.9 million-ton-per-year caster is expected to begin operation in January 1986 and the 2.2 million-ton-per-year caster at Burns Harbor in April 1986.

The Steelton caster will be fed by the plant's electric furnace steelmaking operation, which has a rated annual capacity of 1.3 million tons. As part of Bethlehem's quality emphasis, steel from the plant's furnaces is subjected to argon stirring, a process that provides homogeneous mixing of various additives in the steel, before it is poured through the caster.

Computer System

Bethlehem has also installed a sophisticated computer system at Steelton designed to control the flow of the liquid steel into the casting machine and to track the steel from that point until it is sent on its way as cut blooms.

Once the cast blooms are cut to size and rolled into rail, each rail is subjected to the plant's new in-line, computerized, ultrasonic inspection system to ensure uniformity and cleanliness.

Mannesmann Demag has supplied hundreds of casting machines around the world and has installed and started five machines in the U.S. in the last six months.

One of the considerations for selecting Mannesmann for the project was its many years of proven experience as both a machine operator and a machine builder, Bethlehem said.

Dravo Engineers, Inc., and Dravo Constructors, Inc., were responsible for the $85-million, continuous casting facility's site preparation, demolition of existing buildings, excavation, building and equipment foundations, the casting building (complete with six electrical overhead traveling cranes), placement of all equipment including the casting machine, utility and process piping including 20,000 lineal feet of hydraulic piping, electrical equipment, power distribution and control wiring.

Pittsburgh-based Dravo also furnished a complete water treatment plant which supplies water to cool the mold and casting machine components during operation, as well as water for an atomized water spray system to cool the surface of the steel bloom as it passes through the casting machine.

Mannesmann's U.S. Steel/Lorain strand caster is significantly smaller but no less state-of-the-art.

The continuous casting facility at Lorain is located on the east side of the BOP shop and receives the steel to be cast from this melting facility.

The BOP shop is equipped with ladle metallurgy facilities for the production of the highest quality clean steels.

The continuous casting plant consists of four main aisles or areas.

The first is the ladle bay where steel is received into the casting plant and empty ladles are handled. This bay also serves as a tundish repair area.

The second aisle is the casting bay and contains the casting floor and the top components of the casting machine, i.e. molds, mold oscillators, tundish cars, preheat stations and spray chamber. The south end of this aisle also contains the necessary space and equipment to prepare tundishes for casting. The ladle turret, which holds the ladle during casting, is located between the ladle bay and casting bay and its arms extend into each bay to permit crane service. This ladle turret is capable of handling two ladles.

The third aisle contains the components comprising the discharge end of the machine, i.e. withdrawal-straightener machines, dummy bar disconnecting system, cut-off torches, runout table, dummy bar storage, cross-transfer table and the entry end of the cooling bed. An in-line inspection facility is also located in this bay.

The fourth bay of this facility houses the discharge end of the cooling bed, final inspection and reject tables, finished product storage and shipping facilities. Adjacent to and south of the runout bay is the water treatment plant and office complex.

While conventional wisdom has it that there are no U.S. companies in the continuous caster building or designing business, that is simply not true. Concast and Rokop Corp., in Pittsburgh, are two examples.

British Steel uses a Rokop four-strand caster for billets. The machine casts heats from basic oxygen furnaces from 300 ton ladles on two banks of four strands to produce billets from 4 in. x 4 in. to 6 in. x 6 in. square at casting speeds of 4 m/min.

The caster provides a wide range of

steels for the wire drawing market including carbon and cold heading grades and the machine will have all the equipment necessary to facilitate the casting of billets to the tight specifications such products demand.

Rokop-Davy Ltd. was established as a joint venture by Rokop Corp. of Pittsburgh, U.S.A. and Davy McKee (minerals and metals) Ltd. of Stockton-on-Tees, England, to design and supply worldwide continuous casting machines.

And, in January, 1983 Rokop Corp. started up two other continuous casting machines, one in Australia for Smorgon Consolidated Industries, and one in Youngstown, Ohio for Hunt Steel.

The Hunt caster, the first of its kind for Rokop, produces 10.5 in. round blooms. The three-strand machine has a radius of 40 ft. and an annual production capacity of 300,000 tons/year from 85 ton heat sizes. A full shrouding from ladle to tundish, as well as from tundish to mold, protects the stream.

Smorgon Consolidated Industries started up a two-strand (expandable to three) Rokop billet caster with a 20 ft radius. Smorgon produces 4 in. by 4 in. billets from 60 ton heats. Annual capacity for Smorgon is 210,000 tons/year.

North Star Steel in Beaumont, Texas recently placed an order for Rokop to replace its present starting system on eight strands of its existing two casting machines to the Rokop solid starting bar technology. The casters were originally built by Concast in 1976 with its own chain type starting device.

Scorpion Types

In 1979 Concast replaced these chains with the so-called "scorpion type" starting system, which is technologically somewhere between the antiquated chain type starting system and the Rokop type solid starting bar technology.

Another new melt/cast facility will go into operation at National Metals Industry, Cairo, Egypt, in mid 1986.

The facility, designed with Rokop features, is a three-strand continuous caster to produce billets ranging in size from 4 in. x 4 in. to 6 in . x 6 in. Designed for sequence casting, the caster is supplied by two electric arc furnaces each producing 35 metric tons per heat. Annual production will be approximately 158,000 metric tons.

In addition to the continuous caster and furnaces, auxiliary equipment such as scrap buckets, ladles and cranes; plus, laboratory, maintenance, scrap handling and water treatment facilities are part of the turnkey contract.

All management and engineering will be done in Pittsburgh by the Rokop Corp. and Pennsylvania Engineering Corp. Equipment will be supplied by domestic manufacturers.

One of the more interesting new strand casters in the U.S., however, doesn't represent many of the big names in the business at all. It was, in effect, put together by the purchaser, Babcock & Wilcox.

The caster itself, for example, is from Mecan-Arbed, Luxembourg, and "is the only one built for a customer so far" outside its own steel plant, said Lowell S. Gonano, B&W tubular products group general superintendent of steel operations.

"We don't call it a ladle or caster shop. It's a steelmaking machine," Mr. Gonano adds. "We looked all over the world for the pieces."

Three things make up continuous casting success, he believes. "It's chemistry, deoxidation level and temperature control." According to Mr. Gonano, the company's new plant in Beaver Falls handles all three with computerized ease.

"Our furnace is computer controlled. Others say that, but ours actually works. The computer here really runs it."

The $80 million project increases B&W capacity at the plant by 30 pct and reduces energy costs by 40 pct.

The 80 ton furnace itself was designed by Krupp International, Inc. and is 19 ft in. diam. It's ultra-high powered (UHP) with a water-cooled roof and shell using a 60 MVA transformer. Officially, the furnace operates on a 90 minute cycle, but "in the future we'll be reporting heats under an hour," said Mr. Gonano.

The furnace has three 22-in. electrodes. A fourth hole is for fume extraction B&W reports and a fifth is for flux and carbon feeding.

The furnace uses the "foamy slag" type of melting and is equipped with three oxy-fuel burners. "Everybody's fooling around today with foamy slag. This furnace was designed to run with it," said Mr. Gonano. "It is one of the few efffective foam slag in the U.S.," he said.

According to Hugh Madden, manager of steel operations, the new furnace will function differently than its other furnaces. "In our existing shops, we melt and refine the steel in the furnace. In the new shop, the furnace will only melt the steel. It will then be tapped into a ladle, and from there taken directly to the ladle refining station," Mr. Madden said.

By not using the furnace for the refining process, it will be ready to melt again at a much greater rate.

The steel is tapped from the UHP furnace and from here it moves on to the ladle refining station. The bulk of the alloy additions will take place during reladling.

The ladle refining system (LRS) is a new technique for B&W. "It's unlike anything we've had before," added Mr. Madden. By combining the principles of our present vacuum degassing and argon stirring station with electric arc reheating capability, the ladle refining station will allow us to achieve the optimim chemistry, gas content and temperature control," Mr. Madden explained.

The LRS was designed by Stein-Huerty/Midland Ross and uses a 12 MVA transformer. Steel is continuously stirred during reheating, alloying and desulfurization via a side mounted tuyere in the ladle. Cycle time? About 40 minutes.

According to Mr. Gonano, the operating teams have more than mastered the timing between furnace, ladle and caster.

The Mecan-Arbed caster itself is a four-strand, curved mold machine capable of casting 9 in. x 9 in. square blooms and 5½ in. rounds.

Software was designed by Krupp International, Inc. and the main computer hardware comes from Hewlett-Packard.

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PRICE & PRODUCTION DATA

(Effective July 2, 1984)

Steel production by districts, thousands of tons (000 omitted)

	Last Week	Two Weeks Ago	Month Ago	Year Ago
North East Coast	225	230	264	182
Pittsburgh	233	231	287	30
Youngstown	89	99	116	175
Lake Erie	128	127	160	134
Detroit	167	163	161	134
Chicago	460	487	550	454
Cincinnati	110	109	82	95
St. Louis	83	79	88	72
Southern	199	209	225	135
Western	91	90	94	85
U.S. Production	1,785	1,824	2,027	1,592

Source: American Iron & Steel Institute

Lake Superior Ore Prices

51.50% Fe Natural delivered lower Lake ports. Rail transportation, handling and unloading may be charged to the account of the buyer. Coarse ore 80¢ premium.

Pellets (per iron unit natural).....gross-ton 80.50-86.9*
Mesabi, regular-unscreened .....gross-ton $32.53
Mesabi, non-bessemer.....gross-ton $30.03-31.53**

*80.50¢—Pickands Mather as of 1/27/81.
86.9¢—U. S. Steel as of 3/15/82. Cleveland-Cliffs as of 2/26/82, Oglebay Norton as of 3/25/82, and Hanna Mining as of 2/26/82.
**Effective 8/1/83.

STEEL PRODUCTION, COMPOSITE PRICES

(Effective July 2, 1984)

U.S. Steel Production	Last Week	Two Weeks Ago	To Date 1984	To Date 1983
Net tons, in thousands	1,785	1,824	51,332	39,961
Capability Utilization Rate	68.7	70.2	76.2	53.1

Composite Prices	This Week	Week Ago	Month Ago	Year Ago
Finished Steel Base* (¢/lb.—eff. 5/14/84)	27.405	27.405	27.405	26.217
Pig Iron** (Net ton = 2000 lbs.)	$213.00	$213.00	$213.00	$213.00
Scrap No. 1 hvy.*** (Gross ton = 2240 lbs.)	$ 82.17	$ 85.17	$ 85.17	$ 71.50
No. 2 bundles	$ 52.17	$ 56.17	$ 56.83	$ 46.17

Scrap Comparison (Gross Ton)

No. 1 steel, Pittsburgh..	$ 88.50	$ 94.50	$ 94.50	$ 74.50
No. 1 steel, Philadelphia ..	80.50	80.50	80.50	68.50
No. 1 steel, Chicago.....	77.50	80.50	80.50	71.50
No. 1 bundles, Detroit.....	75.50	82.50	87.50	71.50
Low Phos., Youngstown ..	80.50	89.50	90.50	75.50
No. 1 mach'y cast., Pgh...	79.50	79.50	79.50	74.50
No. 1 mach'y cast., Phila .	98.50	98.50	100.50	98.50
No. 1 mach'y cast., Chi..	115.50	117.50	117.50	108.50

*Finished Steel Composite: Weighted index of steel bars, shapes, plates, wire, rails, black pipe, hot and cold rolled sheets and strips.
**Pig Iron Composite: Based on average prices for basic and foundry pig iron at representative producing points within the U.S.
***Steel Scrap Composite: Average of No. 1 hvy. melting steel scrap and No. 2 bundles delivered to consumers at Pittsburgh, Philadelphia and Chicago.

NONFERROUS PRICES

(Effective July 2, 1984) Prices obtained in trade based on representative tonnages per gross ton delivered to consumer unless otherwise stated.

Primary Metal Prices

(cents per lb.)	current price	last price	date of change
Aluminum (LME)	56.92	57.21	7/2/84
Copper (C)	63.50-66.00	63.00-65.00	6/28/84
Lead	32.00	30.00-32.00	7/2/84
Magnesium Ingot	148.00	143.00	5/25/84
Nickel	329.00	350.00	11/25/81
Titanium Sponge	555.00-585.00	555.00	4/29/82
Zinc	50.00-53.00	51.00-53.00	6/27/84

ALUMINUM: Avg. for last week & previous week. COPPER (C) = cathode. LEAD: common grade. MAGNESIUM: 99.8% pig, delivered. NICKEL: electro., Port Colborne, Canada. ZINC: high grade.

Antimony, American Laredo, Texas	$2.00
Beryllium-aluminum 5% Be, per lb. contained Be	$215.00
Beryllium-copper, per lb. cont. Be	$130.00
Beryllium 97% powder 200	$178.00
Cadmium, ton lots	$2.25
Calcium, ton lots, crown	$3.58
Chromium, 99.8%	$3.75
Cobalt, 99%, cathode	$12.50
Gold per troy oz.	$370.00
Indium, dollars per troy oz.	$3.30-$3.60
Iridium, dollars per troy oz.	$600
Magnesium sticks, 10,000 lbs.	$1.97
Mercury, per 76-lb. f.o.b. N.Y.	$322-$330
Molybdenum, lb. tech. moly oxides, 20 lb. MO can	$6.85
Nickel oxide sinter at U.S. points of entry	$3.12
Palladium, per troy oz.	$140
Platinum, per troy oz.	$475
Rhodium, per troy oz.	$600.00
Silver ingots, per troy oz.	$8.30
Vanadium	$6.00
Zirconium sponge	$12.00-$17.00

(Per lb. unless otherwise noted)

Straits Tin Price

(U.S. cents per lb, EX-SMELTER, based on daily market in Penang in Malaysian dollars per kilo.)

June 25—571.76 June 28—571.26
June 26—571.92 June 29—571.26
June 27—573.25

Scrap Prices
Brass Mill Scrap

(Cents per lb; over 20,000 lbs. add 1¢ per lb)

	Solids	Turning
Copper	63½	60½
Yellow brass	59⅜	57½
Red brass	60⅜	58¼
Comm. bronze	60¾	58½
Mang. bronze	58	54¼
Free cutting rod ends	60	59

Custom Smelters Scrap

(Cents per lb., carload lots, del. refinery)

No. 1 copper wire	58
No. 2 copper wire	48
Light copper	39

Ingot Makers Scrap

(Cents per lb., carload lots, del. refinery)

No. 1 copper wire	54
No. 2 copper wire	44
Light copper	35
No. 1 composition	55
No. 1 comp. turnings	53
Hvy. yellow brass solids	38
Hvy. yellow brass turnings	36
Radiators	42

Aluminum

New mixed clips	44	—45
Old sheet	41	—42
Old cast	41	—42
Clean dry borings	42	—43

Dealers' Scrap

(Dealers' buying price f.o.b. New York in cents per pound)

Aluminum

Segregated clippings	39	—40
Mixed L.C. clips	36	—37
Old sheets and cast	31	—32
Borings and turnings	25	—26
Duraluminum clippings	27	—28

Copper and Brass

No. 1 copper wire	49	—50
No. 2 copper wire	41	—42
Light copper	37	—38
Radiators	35	—36
No. 1 composition	43	—44
No. 1 composition turn'gs	40	—41
Cocks and faucets	31	—32
Clean heavy yellow brass	29	—30
Brass Pipe	30	—31
New soft brass clippings	44	—45

Lead

Heavy soft lead	9	—10
Whole batteries	3	— 4
Type metal	15	—16
Electrotype	13	—14

Nickel

Nickel solids	120	—130
Nickel rod ends	120	—130
Nickel sheets, clips	120	—130
Nickel turnings	60	— 70

Zinc

New zinc clippings	18	— 19
Old diecast zinc	14	— 15

EFFECTIVE JULY 2, 1984

(Effective July 2, 1984) Prices obtained in trade based on representative tonnages per gross ton delivered to consumer unless otherwise stated. Prices are the opinions of *Iron Age* editors and correspondents, based on contacts with dealers, brokers, generators and users in the industry on the effective date listed above.

Ferrous Scrap Prices

Pittsburgh

No. 1 hvy. melting	$ 88.00 to	$ 89.00
No. 2 hvy. melting	78.00 to	79.00
No. 1 dealer bundles	96.00 to	97.00
No. 1 factory bundles (auto)	96.00 to	97.00
No. 2 bundles	57.00 to	58.00
No. 1 busheling	97.00 to	98.00
Machine shop turn	14.00 to	15.00
Shoveling turnings	49.00 to	50.00
Cast iron borings	48.00 to	49.00
Low phos. punchings plate	104.00 to	105.00
Heavy turnings	78.00 to	79.00
No. 1 RR hvy. melting	90.00 to	91.00
Rails 2 ft. and under	114.00 to	115.00
Scrap rails, random lgth.	103.00 to	104.00
RR specialties	105.00 to	106.00
No. 1 machinery cast	79.00 to	80.00
Cupola cast	72.00 to	73.00
Heavy breakable cast	30.00 to	31.00
Stainless		
18-8 bundles and solids	580.00 to	590.00
18-8 turnings	480.00 to	490.00

Chicago

No. 1 hvy. melting	$ 77.00 to	$ 78.00
No. 2 hvy. melting	71.00 to	72.00
No. 1 dealer bundles	91.00 to	92.00
No. 1 factory bundles (auto)	92.00 to	93.00
No. 2 dealer bundles	49.00 to	50.00
No. 1 busheling	91.00 to	92.00
Shredder scrap	89.00 to	90.00
Machine shop turn	42.00 to	43.00
Mixed bor. and turn.	43.00 to	44.00
Shoveling turnings	49.00 to	50.00
Cast iron borings	49.00 to	50.00
Low phos. forge crop	115.00 to	116.00
Low phos. punchings plate ¼ in. and heavier	125.00 to	126.00
Low phos. 2 ft. and under	120.00 to	121.00
No. 1 RR hvy. melting	83.00 to	84.00
Scrap rails, random lgth.	87.00 to	88.00
Reroller rails	108.00 to	109.00
Rails, 2 ft. and under	115.00 to	116.00
RR couplers and knuckles	97.00 to	98.00
RR car axles	124.00 to	125.00
No. 1 machinery cast	115.00 to	116.00
Cupola cast	105.00 to	106.00
Stove plate	101.00 to	102.00
Steel car wheels	107.00 to	108.00
Stainless		
18-8 bundles and solids	540.00 to	550.00
18-8 turnings	440.00 to	450.00
430 bundles and solids	130.00 to	135.00
430 turnings	95.00 to	100.00

Philadelphia

No. 1 hvy. melting	$ 79.00 to	$ 82.00
No. 2 hvy. melting	69.00 to	72.00
No. 1 dealer bundles	90.00 to	93.00
No. 2 dealer bundles	48.00 to	51.00
No. 1 busheling	90.00 to	93.00
Shredder scrap	96.00 to	99.00
Machine shop turn	29.00 to	32.00
Mixed bor. and turn.	29.00 to	32.00
Shoveling turnings	41.00 to	44.00
Low phos. 5 ft. and under	95.00 to	98.00
Low phos. 2 ft. punchings	115.00 to	118.00
Electric furnace bundles	101.00 to	104.00
RR specialties	100.00 to	103.00
Rails, 2 ft. and under	117.00 to	120.00
Cupola cast	70.00 to	73.00
Heavy breakable cast	57.00 to	60.00
No. 1 machinery cast	97.00 to	100.00

Detroit

Broker buying prices per gross ton on cars:

No. 1 hvy. melting	$ 55.00 to	$ 56.00
No. 2 hvy. melting	54.00 to	55.00
No. 1 dealer bundles	75.00 to	76.00
No. 2 bundles	37.00 to	38.00
No. 1 busheling	74.00 to	75.00
Drop forge flashings	49.00 to	50.00
Machine shop turn	45.00 to	46.00
Mixed borings and turn.	23.00 to	24.00
Shoveling turnings	46.00 to	47.00
Cast iron borings	36.00 to	37.00
Heavy breakable cast	38.00 to	39.00
Mixed cupola cast	54.00 to	55.00
Automobile cast	77.00 to	78.00
Stainless		
18-8 bundles and solids	445.00 to	455.00
18-8 turnings	350.00 to	360.00
430 bundles and solids	100.00 to	110.00

Youngstown

No. 1 hvy. melting	$ 66.00 to	$ 69.00
No. 2 hvy. melting	47.00 to	50.00
No. 1 dealer bundles	79.00 to	82.00
No. 2 dealer bundles	35.00 to	38.00
Machine shop turn	13.00 to	16.00
Shoveling turnings	18.00 to	21.00
Low phos. plate	79.00 to	82.00
Electric furnace bundles	76.00 to	79.00
Galvanized bundles	67.00 to	70.00

Cleveland

No. 1 hvy. melting	$ 65.00 to	$ 68.00
No. 2 hvy. melting	42.00 to	45.00
No. 1 dealer bundles	76.00 to	79.00
No. 1 factory bundles	80.00 to	83.00
No. 2 bundles	24.00 to	27.00
No. 1 busheling	78.00 to	81.00
Machine shop turn	10.00 to	13.00
Mixed bor. and turn.	10.00 to	13.00
Shoveling turnings	12.00 to	15.00
Cast iron borings	15.00 to	18.00
Cut structural & plates, 2 ft. and under	110.00 to	113.00
Low phos. punchings plate	110.00 to	113.00
Drop forge flashings	56.00 to	59.00
Foundry steel, 2 ft. & under	65.00 to	68.00
No. 1 RR hvy melting	87.00 to	90.00
Rails, 2 ft. and under	117.00 to	120.00
Rails, 18 in. and under	118.00 to	121.00
Steel axle turnings	67.00 to	70.00
Railroad cast	100.00 to	103.00
No. 1 machinery cast	109.00 to	112.00
Cupola cast	63.00 to	66.00
Stove plate	48.00 to	51.00
Stainless		
18-8 bundles	375.00 to	385.00
18-8 turnings	325.00 to	335.00
430 bundles	80.00 to	85.00

Buffalo

Broker buying prices per gross ton on cars:

No. 1 hvy. melting	$ 69.00 to	$ 70.00
No. 2 hvy. melting	58.00 to	59.00
No. 1 busheling	79.00 to	80.00
No. 1 dealer bundles	79.00 to	80.00
No. 2 bundles	39.00 to	40.00
Machine shop turn	14.00 to	15.00
Mixed bor. and turn.	13.00 to	14.00
Shoveling turnings	17.00 to	18.00
Cast iron borings	22.00 to	23.00
Low phos. plate	98.00 to	99.00
Structural and plate, 2 ft. and under	99.00 to	100.00
Rails, 2 ft. and under	94.00 to	95.00
Scrap rails, random lgth.	74.00 to	75.00
No. 1 machinery cast	79.00 to	80.00
No. 1 cupola cast	59.00 to	60.00

St. Louis

No. 1 hvy. melting	$ 68.00 to	$ 69.00
No. 2 hvy. melting	57.00 to	58.00
Foundry steel, 2 ft.	66.00 to	67.00
No. 1 dealer bundles	68.00 to	69.00
No. 2 bundles	65.00 to	66.00
Machine shop turn	17.00 to	18.00
Shoveling turnings	23.00 to	24.00
Cast iron borings	27.00 to	28.00
No. 1 RR hvy. melting	68.00 to	69.00
Rails, random length	70.00 to	71.00
Rails, 18 in. and under	89.00 to	90.00
RR specialties	85.00 to	86.00
Cupola cast	72.00 to	73.00
Heavy breakable cast	50.00 to	51.00
Stove plate	83.00 to	84.00
Steel car wheels	81.00 to	82.00
Rerolling rails	80.00 to	81.00
Unstripped motor blocks	56.00 to	57.00

Birmingham

No. 1 heavy melting	$ 75.00 to	$ 76.00
No. 2 heavy melting	70.00 to	71.00
No. 1 dealer bundles	75.00 to	76.00
No. 2 bundles	54.00 to	55.00
No. 1 busheling	75.00 to	76.00
Shredder scrap	93.00 to	94.00
Machine shop. turn.	33.00 to	34.00
Shoveling turnings	44.00 to	45.00
Cast iron borings	44.00 to	45.00
Electric furnace bundles	66.00 to	67.00
Elec. furnace, 3 ft. & under	71.00 to	72.00
Structural and plate, 2 ft.	97.00 to	98.00
Structural and plate, 4 ft.	87.00 to	88.00
No. 1 RR hvy. melting	87.00 to	88.00
Scrap rails, random lgth.	82.00 to	83.00
Rails, 2 ft. and under	102.00 to	103.00
Angles and splice bars	87.00 to	88.00
No. 1 cupola cast	85.00 to	86.00
Unstripped motor blocks	67.00 to	68.00

Cincinnati

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 65.00 to	$ 66.00
No. 2 hvy. melting	59.00 to	60.00
No. 1 dealer bundles	77.00 to	78.00
No. 2 bundles	37.00 to	38.00
Machine shop turn	7.00 to	8.00
Shoveling turnings	9.00 to	10.00
Cast iron borings	23.00 to	24.00
Low phos. 18 in. and under	94.00 to	95.00
Rails, random length	76.00 to	77.00
Rails, 2 ft. and under	91.00 to	92.00
No. 1 cupola cast	64.00 to	65.00
Heavy breakable cast	31.00 to	32.00
Drop broken cast	85.00 to	86.00

New York

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 50.00 to	$ 52.00
No. 2 hvy. melting	41.00 to	43.00
No. 2 dealer bundles	23.00 to	27.00
Mixed bor. and turn.	11.00 to	13.00
Machine shop turn	6.00 to	7.00
Shoveling turnings	14.00 to	15.00
Clean cast. chem. borings	35.00 to	36.00
No. 1 machinery cast	89.00 to	90.00
Mixed yard cast	50.00 to	51.00
Heavy breakable cast	10.00 to	12.00
Stainless		
18-8 prepared solids	505.00 to	525.00
18-8 turnings	400.00 to	420.00
430 prepared solids	90.00 to	110.00
410 solids	80.00 to	90.00

Boston

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 65.00 to	$ 66.00
No. 2 hvy. melting	55.00 to	56.00
No. 1 dealer bundles	70.00 to	71.00
No. 2 bundles	39.00 to	41.00
No. 1 busheling	75.00 to	76.00
Shredder scrap	73.00 to	75.00
Machine shop turn	14.00 to	16.00
Shoveling turnings	20.00 to	22.00
No. 1 machinery cast	90.00 to	95.00
Mixed cupola cast	48.00 to	50.00
Heavy breakable cast	18.00 to	20.00

San Francisco

No. 1 hvy. melting	$ 45.00 to	$ 47.00
No. 2 hvy. melting	39.00 to	41.00
No. 1 dealer bundles	35.00 to	37.00
No. 2 dealer bundles	17.00 to	19.00
Machine shop turn	6.00 to	8.00
Cast iron borings	6.00 to	8.00
No. 1 cupola cast	83.00 to	85.00

Los Angeles

No. 1 hvy. melting	$ 46.00 to	$ 48.00
No. 2 hvy. melting	39.00 to	41.00
No. 1 dealer bundles	36.00 to	38.00
No. 2 dealer bundles	17.00 to	19.00
Machine shop turn	10.00 to	12.00
Shoveling turnings	8.00 to	10.00
Cast iron borings	6.00 to	8.00
Elec. furnace, 1 ft. and under (foundry)	77.00 to	79.00
No. 1 cupola cast	77.00 to	79.00

Seattle

No. 1 hvy. melting	$ 71.00 to	$ 73.00
No. 2 hvy. melting	60.00 to	62.00
No. 2 bundles	42.00 to	44.00
No. 1 cupola cast	98.00 to	100.00
Mixed yard cast	85.00 to	87.00

Hamilton, Ont.

Brokers buying price per net ton on cars:

No. 1 heavy melting	$ 86.00
No. 2 heavy melting cut 2 ft. and under	78.00
No. 1 dealer bundles	87.00
No. 2 bundles	48.00
Mixed steel scrap	54.00
Bush. new fact. prep'd.	85.00
Bush. new fact. unprp'd.	75.00
Machine shop turn	41.00
Short steel turn.	43.00
Mixed bor. and turn.	30.00
Cast scrap	73.00

Houston

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 73.00 to	$ 74.00
No. 2 hvy. melting	59.00 to	60.00
No. 2 bundles	42.00 to	43.00
Machine shop turn	16.00 to	17.00
Crushed turnings	36.00 to	37.00
Shredder scrap	78.00 to	79.00
Cut structural plate, 2 ft. and under	100.00 to	102.00
Cut structural plate, 5 ft. and under	89.00 to	91.00
Unstripped motor blocks	60.00 to	61.00
Cupola cast	75.00 to	76.00

DURABLE ORDERS KEEP CLIMBING

The economy experienced a healthy uptick in May. New orders for durable goods in May rose 3.8 pct to $102 billion compared with April's $98.3 billion, Commerce noted.

By the same token, the constantly fluctuating defense orders fell 8.8 pct to $5.7 billion. They also fell in April.

Capital goods new orders without the defense quotient rose 10.4 pct to $28.6 billion compared with April's $25.9 billion. The April figure had fallen compared with March.

Primary metals orders suffered in May—all down compared with April—the total dropping 12.3 pct to $10.6 billion vs. $11.9 billion the previous month. This marked the fifth decline in the last six months. It was also the largest one-month decline since a 14.1 pct drop in March 1983.

Within that category, nonferrous metals orders suffered the greatest drop—16 pct—down to $5 billion compared with $5.8 billion in April. Steel orders were down 9 pct—$4.4 billion to $4.8 billion—and iron and steel castings orders dropped 8 pct.

However, all was health in metalworking. Machine tools new orders were up a whopping 26.5 pct to $320.1 million compared with $253.1 million in April. Within that category, metalcutting tools new orders rose 6.8 pct and metalforming tools new orders rose almost 75 pct. Dollar orders in the latter category were $128.1 million; in the former the figure for May was $192.0 million.

The increases in new orders came as no surprise to observers who have been following the trend lines this year. The increases had been expected in light of a recent report showing that orders for durable goods—products expected to last three or more years—had risen sharply from an April setback.

The improvement in new orders was founded principally in the machinery category which had shown a 10.2 pct decline in April.

Billions of Dollars, Seasonally Adjusted Monthly Total, unless otherwise noted Source: U.S. Dept. of Commerce		Latest Month or Qtr.	Previous Month or Qtr.	Same Period Year Ago
CAPITAL EXPENDITURES (Annual Rates)				
U.S. Industry, Total	1st Qtr.	$332.7	$318.8	$293.0
Manufacturing, Total	1st Qtr.	124.7	116.4	109.9
Manufacturing, Durable Goods	1st Qtr.	59.2	54.9	50.7
Mining Industry	1st Qtr.	13.6	12.4	12.0
KEY INDICATORS, Durable Goods Manufacturing				
New Orders	May	102.0	98.3	84.5
Shipments	May	97.9	95.7	83.0
Inventories	May	180.4	178.0	170.7
Unfilled Orders	May	344.4	340.3	300.8
NEW ORDERS, METALWORKING				
Capital Goods Producers, Nondefense Industries	May	28.6	25.9	22.1
Capital Goods Producers, Defense Industries	May	5.7	6.2	4.7
Primary Metals, Total	May	10.6	11.9	10.0
Steel (SIC 331)	May	4.4	4.8	4.2
Iron & Steel Castings (SIC 332)	May	1.2	1.3	1.1
Nonferrous Metals	May	5.0	5.8	4.7
Nonelectrical Mach.-Equip. Industries, Total	May	18.9	16.9	15.1
Engines & Turbines	May	1.0	1.2	1.1
Farm Machinery & Equipment (Shipments)	May	0.9	0.9	1.0
Construction, Mining & Mat. Hdlg. Equip.	May	3.0	2.6	2.6
General Industrial Machinery	May	1.4	1.4	1.0
Fluid Power Equipment** (Index-1972=100)	May	303.0	310.0	218.0
Metalworking Machinery	May	0.9	0.8	0.7
Machine Tools, Total ($ Mill., Unadjusted)***	May	320.1	253.1	135.3
Machine Tools, Metalcutting***	May	192.0	179.8	93.6
Machine Tools, Metalforming***	May	128.1	73.3	41.7
Electrical Mach. & Equip. Industries, Total	May	17.5	14.7	13.6
Elec. Transmission Equip. & Ind. Apparatus	May	1.9	2.0	1.5
Household Appliances	May	1.6	1.3	1.3
Communication Equipment	May	5.6	4.0	4.3
Transportation Equip. Industrial, Total	May	23.5	24.5	18.5
Motor Vehicles & Parts (Shipments)	May	15.6	15.2	12.3
Aircraft, Missiles & Parts	May	6.1	8.0	4.2
Shipbuilding & Military Tanks	May	1.1	0.4	1.1
Fabricated Metal Products, Total	May	11.5	10.9	10.0
Instruments, Total	May	5.1	4.8	4.0

*Est.—Commerce Dept.; **Source: National Fluid Power Assn.; ***Source: NMTBA